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Executive Summary

The Seventh Annual Meeting of the WCRP/CLIVAR/VAMOS Panel (VPM7) was held at the Escuela Superior Técnica del Litoral (ESPOL), Guayaquil, Ecuador, from 22-24 March 2004. 37 participants from 10 countries attended the meeting. At the opening ceremony, Eng. Armando Altamirano, Vice Rector of ESPOL, represented the host institution. Professor Maria del Pilar Cornejo de Grunauer from the same institution, was the local host. Professor Carlos Ereño represented the CLIVAR ICPO.

VAMOS is one of the WCRP flagships, and is consistently presented as an example of what a WCRP program should be. The program has achieved a stable configuration based on NAME, MESA and VOCALS; it has a Project Office and enjoys database support and is well poised for the future. The year 2003-2004 was very productive in multiple fronts. A major international field campaign was completed with great success (SALLJEX) and another is in the waiting cue (NAME 2004). Participation in a GEF project is opening new grounds for WCRP initiatives. VAMOS, a CLIVAR panel, has strong ties with GEWEX. These ties will tighten in the future, as cooperative projects develop. The VAMOS domain covers two monsoon systems and three Continental Scale Experiments (CSEs), and some of the most interesting sectors of the world's ocean. Challenges to success are great, but the potential contributions to progress in science through coordination and encouragement of research programs are enormous.

The meeting attendees split into three working groups according to the program components. The NAME working group discussed the readiness for NAME 2004, and the strengthening of an ocean component in NAME Tier 3. The MESA working group reexamined the component structure and the ongoing projects on La Plata Basin. The VOCALS working group identified goals of an international research program with strong atmospheric and ocean components.

A plenary session provided several recommendations for a continued VAMOS success: 1) to maintain a yearly frequency for VAMOS panel meetings, 2) to develop a modeling strategy in order to guarantee the existence of strong linkages between all VAMOS components (MESA, NAME and VOCALS) and facilitate links with operational centers, and 3) to develop an across-VAMOS "Modeling and Data Assimilation Implementation Plan" that provides a roadmap for VAMOS activities in the related areas. It was also recommended that the VAMOS Panel conduct an assessment of its components, including the possible definitions of others focused on climate phenomena of great interest in the Americas that are not covered so far.

VPM7 was my last meeting as the VAMOS chair, a position I have been honored to hold since the panel creation. By unanimous vote the panel decided to nominate Professor C. Vera (U. Buenos Aires) and Dr. Wayne Higgins (NOAA/NCEP) as panel co-chairs starting after the CLIVAR Conference. My warmest congratulations to Carolina and Wayne, and my best wishes for the future of this wonderful CLIVAR component.

C. Roberto Mechoso, Chair
WCRP/CLIVAR/VAMOS

1. Welcome and Opening Remarks

The WCRP/CLIVAR panel on the Variability of American Monsoon Systems (VAMOS) held its Seventh Annual Meeting (VPM7) at the Escuela Superior Técnica del Litoral (ESPOL), Guayaquil, Ecuador, 22-24 March 2004. 37 participants from 10 countries attended the meeting. Professor Maria del Pilar Cornejo de Grunauer, from the host institution, acted as focal point for the meeting organization. She opened the event by warmly greeting the attendees and going over the local arrangements. (A complete list of attendees is given in Appendix 1, Appendix 2 has the meeting agenda and Appendix 3 has a list of the acronyms used in this report).

The first formal speaker at VPM7 was Eng. Armando Altamirano, Vice Rector of ESPOL. He welcomed the panel and invited experts to Guayaquil and expressed that his organization was very pleased to host a VAMOS meeting. He also presented an interesting overview of the main activities at ESPOL, with an emphasis on those of the School of Marine Engineering and Marine Sciences. Scientists from this school are engaged in VAMOS activities,

Prof. Carlos Ereño, contact of the International CLIVAR Project Office (ICPO) for VAMOS, addressed the participants on behalf of the ICPO Director, Dr. Howard Cattle. Professor Ereño described several key activities are under development by CLIVAR. Of these, he highlighted the CLIVAR Conference to be held in Baltimore, June 2004, and the ongoing assessment of all CLIVAR panels and groups in order to base future activities. He thanked the agencies that provided support for VPM7: WCRP, ICPO, NOAA OGP, NOAA PACS and US CLIVAR Project Office. A special acknowledgement was given to ESPOL for the excellent organization of the event.

Professor C. Roberto Mechoso (U. California Los Angeles), Chair of the VAMOS panel, closed the opening ceremony. He acknowledged the participants for coming from different part of the world, the different funding agencies for their support, and ESPOL for hosting VPM7. He also said that VAMOS has brought together climate scientists from the Americas, as well as their colleagues from other continents, in order to advance the understanding, modeling and prediction of monsoon systems. Professor Mechoso praised the beauty of the host country, and referred the participants to the attractive boardwalk along the Guayas river, where a statue commemorates the meeting in Guayaquil between two great leaders of the independence movement in South America: Simón Bolívar and José de San Martín.

2. Reports and Scientific Presentations

2.1 US CLIVAR Report

The first speaker after the opening session was Dr. Robert Weller (WHOI), who presented an overview of activities under U.S. CLIVAR. This national panel focuses on the causes for and predictability of variability of the earth's climate on time scales from seasons to centuries and on distinguishing natural from anthropogenically induced variability. A U.S. CLIVAR Science Plan was produced in 1995 and a Scientific Steering Committee was started in 1998. U.S. CLIVAR seeks to contribute along with its counterparts in other countries to the long term legacy of an improved climate prediction system, a more comprehensive and useful climate record, improved understanding of the critical physical processes, and to reduce uncertainties in coupled climate models used for prediction. Enhanced observational campaigns, process and empirical studies, and modeling approaches will all be used to achieve these goals.

U.S. CLIVAR, like International CLIVAR, is organized around a global component, basin panels, and modeling working groups. Dr. Weller reviewed the present status and plans for U.S. CLIVAR activities on the global and basin scales. Global climate observations are moving ahead and increasing numbers of Argo profiling floats and of long-term moorings along with ongoing deployments of surface drifters are among the global elements that will benefit VAMOS. Interest in the U.S. Atlantic panel continues in tropical Atlantic variability and the Atlantic ITCZ region, which may provide some intersection of interest with VAMOS. Interest also continues in the decadal modes in the Atlantic and in the meridional overturning circulation. The U.S. Pacific Panel is developing plans for an eastern equatorial Pacific upwelling and mixing experiment called PUMP (Pacific Upwelling and Mixing Physics) and for a air-sea interaction, surface

mixed layer and upper ocean process study called SOAP (Subtropical Ocean-Atmosphere Processes). It includes as its goals improved prediction of ENSO and improved understanding of the Pacific Decadal Variability.

The U.S. Pan American Panel has worked in close association with VAMOS, with U.S. participation in EPIC (Eastern Pacific Investigation of Climate) and the Monsoon Experiment in South America (MESA). Work on the North American Monsoon Experiment (NAME) will begin soon. U.S. investigators have an interest in continued work in the stratus deck region off Chile and will participate in developing the VOCALS (VAMOS Ocean Cloud Atmosphere Land Study) effort.

U.S. CLIVAR has developed the Climate Process Team (CPT) approach, in which teams of observationalists, diagnosticians, process modelers, and coupled modelers work together to speed the improvement of coupled models by developing and testing improved parameterizations. U.S. CLIVAR will be emphasizing integration of modeling and observations and progress towards improved prediction and applications. It is very interested to continue a close working relationship with other countries involved in VAMOS, to learn about plans and resource needs for future VAMOS field efforts, and to hear VAMOS' plans for integration of these observational programs with efforts to improve models and predictions. It would like to see the plans for VOCALS and other work beyond NAME developed further.

2.2 VAMOS Chair Report

The first part of Professor Mechoso's presentation was dedicated to a brief overview of CLIVAR on behalf of Professor Anthony Busalacchi, SSG Co chair and representative to VAMOS, who was unable to attend the meeting. The overview included a summary of CLIVAR highlights during 2003-04, such as the Argo deployments (1000+ with a target of 3000 by 2006), Global Synthesis and Observation Panel (GSOP) as one of the synthesis activities, transition of SALLJ to MESA and PLATIN, impacts of EPIC on parameterization (concept of Climate Process Team, CPT), Southern Ocean space-time observations and the Good Hope Project, formation of the Indian Ocean Panel, and advances on CLIVAR Data Management, under its new strategy for Coordinated Observation and Prediction of the Earth System (COPES). WCRP is establishing a Modeling Panel and a Working Group on Observation and Assimilation (WGOA) of the Climate System.

Turning to VAMOS, Professor Mechoso reviewed the programme's organization. This is based on three components: 1) NAME, which is currently coordinating the field experiment NAME 2004; 2) MESA, which coordinated SALLJEX and co-sponsors the PLATIN Science Study Group (SSG) jointly with the GEWEX Hydrometeorology panel (GHP) for studies on La Plata Basin (LPB), and 3) VAMOS Oceans-Clouds-Atmosphere-Land Studies (VOCALS), which focuses on the eastern tropical Pacific. VAMOS has a Project Office located at UCAR/Joint Office for Science Support (JOSS), which has established a web site (http://www.joss.ucar.edu/vamos/), and developed a database (http://www.joss.ucar.edu/vamos/data/) with a mirror site in South America (http://vamos.iai.int/).

NAME has been very active during 2003-04. Contributing scientists participate in the Soil Moisture Field Experiment (SMEX04), which was funded by NASA THP in April 2003. A NAME Ocean Component Workshop was held in Ensenada, Mexico, April 2003 (ocean and land processes). A NAME Hydrometeorology Working Group formed in January 2003. A Modeling and Data Assimilation Workshop was held in College Park, Maryland, USA, in June 2003. A Modeling and Data Assimilation Strategy Document was completed and is currently under review taking into account comments by the US CLIVAR Pan American Panel. The document aims at accelerating progress on the fundamental modeling issues pertaining to the NAME science objectives. A field campaign (NAME 2004) will be held in the northern summer of 2004.

MESA has also been very dynamic since VPM6, building on the momentum created by its highly successful South American Low-Level Jet Experiment (SALLJEX). There was a number of data collection and quality control activities, data analysis and diagnostic studies, and coordinated modeling experiments. A SALLJEX Data Workshop was held in Buenos Aires, Argentina, 10-12 December 2003. SALLJEX contributes to the development of the GCOS action plan for South America. A MESA component, the Plata Basin Science Study Group (PLATIN SSG) is coordinating the LPB Climate and Hydrology Project (LPBP). LPBP aims to improve the understanding and prediction of LPB's climate and hydrology based on their unique sensitivity

to the variability of remote climates, regional geographic features and connections with the large Amazon basin. The GEWEX SSG recognized at its last meeting in Marrakech, Morocco, 23-30 January 2004, that the LPBP coordinated by the PLATIN SSG qualifies as a Continental Scale Experiment (CSE).

PLATIN scientists are also involved in building "A Framework Strategic Action Plan for La Plata Basin." The initiative has funding from the Global Environmental Facility (GEF), and has the United Nations Environment Programme (UNEP) and Organization of American States (OAS) as the requesting and executing agencies, respectively. Activities are coordinated by the Intergovernmental Coordinating Committee for La Plata Basin (CIC) in co-operation with water agencies from Argentina, Bolivia, Brazil, Paraguay, and Uruguay. One major goal of this large international initiative is to improve the climate and hydrology predictions in the LPB. Professor Mechoso is coordinating an activity that also involves many other PLATIN scientists.

The progress achieved in sharpening the definition of the VAMOS Oceans-Clouds-Atmosphere-Land Studies (VOCALS) was acknowledged. VOCALS targets the time and space scales of cloud-topped boundary layer and continent interaction; regional seasonal/interannual feedbacks between stratocumulus clouds, surface winds, upwelling, coastal currents and SST in the Eastern Pacific; feedbacks of Eastern Pacific cloud topped boundary layer properties on overall tropical circulation and ENSO; and the climatic importance of aerosol-cloud interactions.

VAMOS contributes to the WCRP's Coordinated Enhanced Observing period (CEOP). The organization and structure of CEOP and its Monsoon System Study Framework were presented. Monsoon studies encouraged by CEOP aim to provide better understanding of fundamental physical processes underpinning the diurnal and annual cycles, and intraseasonal oscillations in monsoon land and adjacent oceanic regions of Asia, North America and South America, Australia, and Africa.

Professor Mechoso said that VAMOS is addressing major issues and facing important challenges. In regard to the issues he said that CLIVAR and GEWEX programs, particularly those with an important component over land such as VAMOS, would greatly benefit from a closer cooperation between WCRP and National Meteorological Services. NAME has demonstrated that such collaboration could be achieved on a one-to-one basis. SALLJEX, however, found that a similarly close partnership is difficult to achieve it in a multi-country region. PLATIN is showing that mechanisms currently in place to address this problem are not effective. On the positive side, the links between VAMOS and GEWEX panels have strengthened. The approaches by NAME to GAPP and by MESA (PLATIN) to GHP have been warmly received. VAMOS looks forward to collaborating with the GEWEX modeling panels. There are two important challenges for a mature VAMOS. One challenge is to formulate clearly the overarching science questions to be addressed in reference to the climate of the Americas, particularly during the warm season. Another challenge is to define the focus of a program on VAMOS modeling, namely to identify the aspects in which VAMOS modeling will contribute to a better simulation and prediction of the monsoon systems.

2.3 ICPO Report

Professor Ereño explained the functions of ICPO. He highlighted CLIVAR Exchanges. This periodical publication devoted its December 2003 issue to Coupled Modeling and its March 2004 issue to SALLJEX, and will dedicate the June 2004 issue to Applications of CLIVAR Science. Each issue is about 32 pages in length, and approximately 1700 copies are distributed widely.

Next Professor Ereño reported on the preparations for the First International CLIVAR Science Conference, CLIVAR 2004, to be held in Baltimore, USA, June 21-25. He said that flyers describing the different panels were especially designed for this occasion for distribution to the participants, and displayed the VAMOS flyer. He added that 33 candidates from 7 Latin-American countries requested financial support to attend the Conference. WCRP, US CLIVAR and the Inter-American-Institute for Global Change Research (IAI) will provide support to 10 participants.

Another important activity of the ICPO was the implementation of a CLIVAR SSG Scientific Steering Group (SSG) decision to conduct a self-assessment of the programme along its main streams (i.e. GOALS, DecCen and ACC) and unifying themes (i.e. "Data" and "Modeling"). All CLIVAR panels were requested to

provide a summary of accomplishments in reference to what they set out to do, and of expected achievements by a CLIVAR sunset date in 2013. The self-assessment will be discussed during the SSG meeting scheduled to be held in Baltimore, Maryland, U.S., immediately after the CLIVAR Conference (SSG-13). In regard to the CLIVAR SSG, Tim Palmer (ECMWF) replaced Jurgen Willebrand (U. Kiel) as one of the group's co-chairs, while Tony Busalacchi (U. Maryland) remains as the other co-Chair.

Professor Ereño finished his presentation by introducing the first issue of the VAMOS newsletter (VAMOS!). This first issue, which was issued in March 2004, has 16 pages and was distributed to 1400 subscribers as well as to the meeting participants. The articles featured an introduction of VAMOS and its components. Future issues are planned with an annual frequency

2.4 VAMOS International Project Office

The director of the VAMOS International Project Office, Dr. Gus Emmanuel (UCAR JOSS) described the support provided to the SALLJEX Data Workshop, which was held in Buenos Aires during December 10-12, 2003. Nearly 50 participants from several countries attended the event.

The Project Office is actively contributing to the planning for the field phase of NAME. Several site surveys were conducted to identify suitable locations for the S-POL radar, several profilers, upper air profiling stations, etc. In addition, the Project Office made arrangements with the Mexican Navy to use its oceanographic vessel *Altair* for a six-week period in order to support the data collection requirements at the entrance to the Gulf of California (23.5N, 108W). Arrangements were also made to increase the WP-3D flight hours from 56 to 80. The WP-3D will operate during July 5 – August 12 from Mazatlán, Mexico.

The primary operations center for NAME04 will be located in Tucson, Arizona. Daily meetings will be held in order to decide on the activities during the next 24-48 hours, such as scheduling intense observing periods (IOPs) and research flights. The JOSS field data catalogue will be available for PIs and interested parties during the experiment. Currently, information on NAME may be obtained from its web page at JOSS (www.joss.ucar.edu/name.

2.5 VAMOS Data Management

Dr. Jose Meitin informed that the VAMOS Project Office has established a web site with information on the various projects supported by the office (http://www.joss.ucar.edu/vamos/). A Data Server web site can be found at http://www.joss.ucar.edu/vamos/data/) with a "mirrored" server, for the Southern Hemisphere, located at IAI (http://vamos.iai.int/). These distributed information systems contain links to various related VAMOS programmes and to data sets of interest (i.e., in-situ [land, ocean], satellite, model output). As of VPM7, over 195,000 files (over 31 GB of data) are available on-line to the scientific community. The VAMOS Data Working Group, charged with coordinating data access for both national and local data sets, continued their activities the past year. The group membership comprises representatives of various countries in the Americas making contributions to VAMOS. Next, Dr. Meitin gave a brief summary of the various VAMOS-related project activities since the last panel meeting.

PACS – The long-term enhanced climate monitoring and archival continues including data from Intensive Observational Periods (IOPs), such as the TEPPS (1997) cruise and VAMOS-related field projects (e.g. SALLJEX, EPIC). The PACS database provides stability and continuity using common formats, a data portal, and ease of data access. The satellite climatology consists of various high-resolution sectors that are routinely produced and archived by UCAR/JOSS (2000 to present). Further details (and links to these datasets) are provided at the PACS data management page located at http://www.joss.ucar.edu/pacs/.

EPIC - Approximately 150 data sets are expected to be submitted to the EPIC data base, of which 125 are either currently available or in the process of being loaded). The NOAA P-3 aircraft data were processed to a common format with the NSF C-130 aircraft. An upper air sounding "composite" was generated using all available rawinsondes and dropsondes converted to a common format and analyzed using uniform quality control procedures. A complete high-resolution satellite data archive (GOES/POES) was compiled and is available. Off-line data sets (such as aircraft radar data on tape) continue to be loaded on-line. Further details

(and links to these datasets) are available from the EPIC data management page located at http://www.joss.ucar.edu/epic/dm/.

SALLJEX – The presentations at the SALLJEX Data Analysis Workshop, as well as other project information and results, have been posted on the web at: http://www.joss.ucar.edu/salljex/workshop/index.html. The SALLJEX data policy (adopted by the SALLJEX SWG) provides a good "model" for an overall VAMOS data policy. During the field phase, a web-based field catalogue for SALLJEX was populated with operational and research product imagery and various reports (daily operations, mission summary, and status). A "merged" GOES northern/southern hemisphere high-resolution (30-min, 1-km visible) satellite sector was routinely produced and archived. Approximately 65 data sets are now available or in the process of being loaded to the SALLJEX database. All SALLJEX data management information, activities, and data access are located at the SALLJEX data management page located at http://www.joss.ucar.edu/salljex/dm/.

NAME - The NAME data management strategy is under development (i.e. data policy, plan, etc.) and work has begun with surveying (and working with) available data sources such as the new special rain gauge network in Mexico. A pre-field NAME quantitative precipitation forecast verification exercise was held during the monsoon season (summer 2003) which involved the use of the NAME on-line field catalogue and the archival of operational and verification datasets. Extensive work was accomplished in preparing an on-line database of model output (and upper air verification data) from the summer of 1990 to support the NAME Model Assessment Project (NAMAP). Further details (and links to forecast verification and NAMAP datasets) are available from the NAME data management page located at http://www.joss.ucar.edu/name/dm/.

PLATIN – JOSS has designed and developed a "home" web page for the PLATIN project (http://www.joss.ucar.edu/platin/). PLATIN is still in its development phase and a survey of available data sources and sets is currently underway. A prototype GIS-based Map Server for this basin has been developed and is available from the new PLATIN home web page. This tool will be helpful during the planning stages for the coordination of research and data activities. Further details are available from a new PLATIN data management page located at http://www.joss.ucar.edu/platin/dm/.

CEOP - Data management activities for CEOP that are important for VAMOS include the development of in-situ data sets from 36 Reference Sites distributed globally in various climate regimes. These data sets consist of an hourly and 30-min "composites" of designated upper air, surface, and sub-surface parameters all converted to a common format and analyzed using uniform quality control procedures. All Reference Site data are being archived (and available) from UCAR/JOSS. CEOP model output (from 10 numerical weather prediction centres) are being archived at the German Computing Centre at Max Planck Institute, and satellite data are being archived at the University of Tokyo (Japan). Further details (and links to these datasets) are available from the CEOP data management page located at http://www.joss.ucar.edu/ghp/ceopdm/.

2.6 VOCALS Status Report

Professor Chris Bretherton (U. Washington) has been informally leading the VAMOS Ocean Cloud Atmosphere Land Study (VOCALS), a developing process study within VAMOS. The main objective of VOCALS is to better understand and simulate how marine boundary layer cloud systems surrounding the Americas interact with the coupled ocean-atmosphere-land system on diurnal to interannual timescales. Active VAMOS participants in VOCALS are B. Albrecht, C. Fairall, C. R. Mechoso, A. Miller, B. Stevens, and B. Weller from the US; R. Garreaud and J. Ruttlant from Chile; R. Terra from Uruguay; P. Lagos from Peru; and P. Cornejo from Ecuador. R. Weller accepted to assume VOCALS leadership after VPM7.

VOCALS-related scientific issues include the time and space scales of cloud-topped boundary layer/continent interaction; regional seasonal/interannual feedbacks between stratocumulus clouds, surface winds, upwelling, coastal currents and sea surface temperature (SST) in the eastern Pacific; feedbacks of eastern Pacific cloud topped boundary layer properties on overall tropical circulation and ENSO; and climatic importance of aerosol-cloud interactions. VOCALS scientists have recently discovered a daytime subsidence wave initiated by Andean slope heating that propagates about 1500 km offshore over the southeastern Pacific stratocumulus region, lowering inversion and enhancing daytime cloud thinning. Also,

strong aerosol/drizzle/cloud fraction feedbacks in the southeastern Pacific. Aerosol concentrations decrease away from coast. Clean stratocumulus are drizzly, more cellular, and with a lower cloud fraction. The MODIS (Moderate Resolution Imaging Spectroradiometer) instrument has retrieved effective cloud droplet radius and showed them to be larger in clean areas, small in coastal pollution areas, and excessive in patches of open cells.

To achieve its goals VOCALS has set a strategy based on global and mesoscale model evaluation and improvement (e.g. parameterization development) using multiscale data sets, and model sensitivity studies to refine hypotheses and target observations. These approaches are complemented by synthesis/use of existing data sets, enhancement through targeted instrument procurement, algorithm evaluation and development and intense observation periods, and co-ordination with oceanographic, aerosol, cloud process communities, including CLIVAR cloud CPT, CLOUDSAT, etc.

The presentation on VOCALS included an overview of its program of observational enhancements. At the time of VPM7 there are 3.5 years of WHOI stratus buoy (20°S 85°W) data (R. Weller) documenting surface meteorology, energy budget, subsurface cooling by ocean eddies and waves. The U. Chile (J. Ruttlant/R. Garreaud) has installed a ceilometer and surface meteorology instruments at San Felix Island. Buoy maintenance cruises that occur for two weeks every October-November now have PACS-supported NOAA/ETL surface meteorology/cloud remote sensing (C. Fairall). There is also a nascent JOSS VOCALS archive, starting with GOES satellite data and products.

Professor Bretherton is leading a Climate Process Team (CPT) centered on reducing the uncertainty in low-latitude cloud feedbacks on climate sensitivity. The team will accelerate progress in improving the representation of cloud feedbacks through in-depth diagnosis of cloud feedbacks in models, implementation of 'best-practices' parameterizations honed via single-column methods, newest observations. The work has started with boundary-layer clouds, and will move later to deep convective systems. The team activities and those of VOCALS intersect in several aspects, such as the modeling of the apparent local aerosol-cloud-drizzle feedbacks.

The CPT is organized as a core group focused on parameterization, model diagnosis, and observational hooks (C. Bretherton, M. Khairoutdinov, C. Lappen, B. Mapes, J. Norris, R. Pincus, B. Stevens, K. Xu, M. Zhang), and an advisory group (B. Albrecht, A. Betts, C. Fairall, T. del Genio, S. Ghan, G. McFarquhar, C. R. Mechoso, H. Pan, D. Randall, D. Raymond, J. Teixeira and R. Weller). The team has representatives from NCAR (J. Kiehl, P. Rasch, W. Collins), GFDL (S. Klein, I. Held, and L, Donner, with M. Zhao acting as liaison), and GMAO (J. Bacmeister and M. Suarez).

Dr. Bretherton finished his presentation describing the VOCALS "radiator-fin" experiment, which was introduced at VPM6. The experiment could take place in Oct. 2007, along a transect between the WHOI buoy and the coast that would include studies on cloud/aerosol interactions, PBL diurnal cycle, and mesoscale ocean structure. It could last 3-4 weeks, surveying atmosphere, ocean, and clouds in a radiator pattern by ship with aircraft flights along the transect. A major contribution and participation by South American scientists and institutions will be required to realize these plans.

2.7 MESA Status Report

Dr. Carolina Vera, chair of the MESA component of VAMOS, listed the program activities. Several of these were motivated by the results obtained in the SALLJ field campaign (SALLJEX), which was performed with great success between 15 Nov 2002 and 15 Feb 2003 in Bolivia, Paraguay, central and northern Argentina and western Brazil. SALLJEX aimed at describing many aspects of the SALLJ using a blend of observing systems. The experiment was carried out as an unprecedented collaboration among scientists, collaborators, students and local volunteers from Argentina, Brazil, Bolivia, Paraguay, Chile, Uruguay, Perú, and the U.S. SALLJEX was primarily funded by NOAA/OGP with additional contributions from NSF and funding agencies from Brazil and Argentina. SALLJEX is the first WCRP/CLIVAR international campaign in South America. Further information is available at http://www.joss.ucar.edu/salljex. The list of SALLJEX post-fields activities include:

March 2003-: Data collection and quality control

March 2003-: SALLJEX database construction
March 2003-: SALLJEX related research starts
23-26 April 2003: SALLJ/SWG Meeting in VPM6.
May 2003-: SALLJEX numerical experiments
10-12 Dec 2003: SALLJEX Data Workshop. Buenos Aires, Argentina.
15 December 2003: Submission of SALLJEX related posters to the CLIVAR Conference
January-March 2004: Preparation of CLIVAR Exchanges issue for SALLJEX
2003-2004: VAMOS/SALLJ Contribution to GCOS Action Plan over South America.

The development and maintenance of a comprehensive and accurate data archive is a critical step in meeting the scientific objectives of SALLJEX. A series of data management activities have been supported under the VAMOS Programs Project Office. The goal of SALLJEX data management is to make the completed data set available to the research community as soon as possible following the field campaign. SALLJEX data were collected from a variety of field activities lead by researchers either individually or as a group, and archived for the period 1 November 2002 to 28 February 2003 at one of the distributed SALLJEX Data Archive centers (SDA). The performance of high-quality measurements during the field campaign, application of quality and error checking procedures, and the incorporation of data and related documentation to the SDA required substantial coordination, financial and logistical efforts by the data providers. The support for these activities was provided by a variety of international, national and institutional sources. The SALLJEX data are available to the scientific community through a distributed archive coordinated by JOSS, in Boulder Colorado, USA (www.joss.ucar.edu/salljex/dm).

A SALLJEX Data Workshop was held in Buenos Aires from 10-12 December 2003. The general objectives of the meeting were to: a) assess what progress has been made on SALLJEX objectives, b) strengthen and arrange collaborations among the participants in the experiment, c) broaden participation in order to expand the use of the data by other scientists and their students for analyses and modeling, and d) determine follow-up activities. The workshop program as well as pdf versions of the presentations are available at www.joss.ucar.edu/salljex/workshop. The technical presentations covered the status of the SALLJEX data, including processing and quality control, and described preliminary data analyses and numerical simulations performed either as collaborative or as individual efforts. The preliminary results of coordinated experiments by models from several institutions were discussed at the workshop (see section 2.9 of this document). Plenary sessions concentrated in assessing the extent to which SALLJEX is meeting its motivating and design goals. The possibility of a broader involvement by other potential interested investigators, and the encouragement of additional joint activities that can be helpful to achieve the program objectives, were discussed. A plenary session addressed the evolution of the SALLJ Program in the broader context of MESA, and particularly the realization of a field experiment on precipitation variability in LPB.

The main scientific results provided by SALLJEX so far are highlighted in the No. 29 (Vol. 9, No. 1) of CLIVAR Exchanges (available in pdf version at http://www.clivar.org). The results have raised further science questions and suggested ways for improvement of the observational system in South America. In this regard, a project brief for an upper-air network enhancement over central South America has been included in the GCOS regional action plan for South America (available soon at http://www.wmo.ch/web/gcos).

The status of the PLATIN Project, the other main MESA component, is reported in section 2.2.

2.8 NAME Status Report

Dr. Wayne Higgins, chair of the NAME component of VAMOS, provided an overview of the component status with an emphasis on the NAME 2004 Field Campaign and NAME modeling and diagnostic studies. Over the year preceding VPM7, NAME has developed its linkages with several agency programs that are providing support for NAME 2004 (including NOAA/OGP, NOAA / NWS, NASA/THP, USDA/ARS, NSF GEO/ATM, Hydro; NCAR/ATD; NOAA/ ETL and NOAA/AL). NAME is the first field campaign supported by NOAA/OGP's Climate Prediction Program for the Americas (CPPA). The CPPA interest in NAME is to improve intraseasonal to interannual climate forecasts for the warm season. CPPA will continue to support diagnostic and modeling studies in the warm season after NAME 2004. NAME has worked very closely with the Mexican Weather Service and with several universities and institutions in

Mexico and Central America (including UNAM, IMTA, CICESE, and U. Costa Rica) to develop its international partnerships.

In addition to focusing plans for the NAME 2004 Instrument Networks (discussed by D. Gochis on Tuesday, March 23, Morning Session – First Part: Plenary), the NAME Science Working Group has also organized Forecast Operations Centers (Tucson, AZ, and Mexico City, Mexico) for NAME 2004. Activities for the Forecast Operations Centers include a forecaster rotation and daily shift schedule, daily forecast preparation, daily briefings to the NAME Science Director, and participation in the NCEP Hydromet Testbed. A NAME composite precipitation dataset, which includes estimates of precipitation over the NAME domain from satellite, gauge, radar and multisensor, will be used for forecast verification, and for intercomparison and NAME data impact studies.

Over the past year a NAME Modeling-Observations team compiled a "White Paper" that provides a strategy for accelerating progress on the fundamental modeling issues pertaining to the NAME science objectives. The "White Paper" contains a roadmap of NAME modeling activities, including forecast system development, experimental prediction, diagnostics and analysis, and applications and product development. The latest version of the "White Paper" is available on the NAME web page at http://www.joss.ucar.edu.

2.9 SALLLJEX Modeling Activities

Dr. Celeste Saulo (U. Buenos Aires, Argentina) reported on modeling activities carried out in support of SALLJEX. These contribute to the modeling goals of MESA, which are the improvement of climate and hydrological predictions in South America on seasonal and intraseasonal time scales. A three-tier strategy was established to achieve this goal, based on 1) testing of hypothesis with models, 2) detecting deficiencies in the models and improving their performance, and 3) developing new parameterizations and model components.

The SALLJEX community established a modeling network that was very active during the Field Campaign, providing daily operational forecasts that aided in the decision of setting up IOPs (Intensive Observing Periods), and in the planning of NOAA-P3 flight missions. This modeling network consisted of regional models (like Eta, MM5 and RAMS) run at different countries (Argentina, Brazil, Chile and the US). The model outputs are available at http://www.joss.ucar.edu/salljex/dm. A model intercomparison experiment was organized (http://www.salljex.at.fcen.uba.ar) after the Field Campaign in order to provide insight on the forecast issues relevant to the scientific objectives. One key concern has been to assess the degree of dispersion between forecasts generated with identical initial and boundary conditions, and very similar model domain and resolution. C. Saulo (CIMA/U. Buenos Aires) and C. Campetella (CIMA/U. Buenos Aires) have coordinated this activity in collaboration with H. Berbery (ETA model at the U. Maryland), R. Garreaud (MM5 model at the U. Chile), D. Herdies (global model at CPTEC/INPE), C. Menendez (MM5 model at CIMA-CONICET, U. Buenos Aires), M. Nicolini (RAMS model at the U. Buenos Aires), M. Seluchi (ETA model at CPTEC/INPE) and Pedro Silva Dias (RAMS model at the U. São Paulo).

The results from this intercomparison experiment have motivated research on other aspects of the prediction problem. One of these aspects refers to data assimilation and the possible impact on predictions of the additional data collected during SALLJEX. I. Cavalcanti and D. Herdies have been comparing forecasts by the CPTEC/COLA model that either use the traditional database or include SALLJEX data. Other aspects include regional data assimilation (P. L. Silva Dias and M. Nicolini), model development in order to minimize spurious impacts of steep orography on model initialization and forecasts (P. L. Silva Dias), and sensitivity of forecasts to convective parameterization (CPTEC, U. Sao Paulo). Since predictability assessments indicate that the strong convective development over 17-18 January 2003 during the SALLJEX period is highly sensitive to initial conditions, different studies are under way to determine whether this is a common feature of similar events during the warm season (U. Utah, CIMA/U. Buenos Aires, and U. Maryland).

2.10 NAME Modeling and Diagnostic Activities: CPT and Forecast Experiment

Kingtse Mo (NCEP, USA) reported on recent developments on modeling and data assimilation activities and future plans at NAME. In regard to modeling, it has been found that predictability of the summer circulation

is comparable with that for winter. To successfully forecast monsoon rainfall, it is essential for the model to capture regional circulation features associated with the monsoon development. The model needs to have adequate horizontal resolution, and realistic representations of physical processes.

A number of experiments were performed in order to examine the impact of horizontal resolution on monsoon rainfall forecasts. The results indicate that a horizontal resolution T126 or higher is needed to resolve the Gulf of California moisture surges, which are essential to monsoon rainfall forecasts. The approach based on a regional model nested in a low-resolution global model (e.g. T62 resolution) to enhance rainfall will succeed only if the global model is able to provide realistic circulation anomalies in the monsoon region.

One forecast and one model assessment experiment are planned during the NAME 2004 period. For the forecast experiment seasonal precipitation and surface temperature forecasts for June-August 2004, and July-September 2004 will be requested. Both statistical and dynamical forecasts will be welcomed. The model assessment experiment (NAMAP 2) is planned in order to address the CPT and diurnal cycle of rainfall and circulation anomalies. One task for the future will be to test soil moisture data obtained from the NAME 2004 in order to examine whether a better initialization of this field will enhance rainfall prediction. NAME scientists will work together with the hydrometeorological team, IRI and other groups toward forecast applications.

2.11 NAME Modeling and Diagnostic Activities: NAMAP

Professor David Gutzler (U. New Mexico) has been coordinating the North American Monsoon Experiment Model Assessment Project (NAMAP). This effort is intended to establish a baseline of model control runs in advance of the NAME field campaign in boreal summer 2004. Six atmospheric modeling groups (using four regional and two global models) each carried out a simulation for the summer of 1990, a wet year for the North American monsoon. Each model used the same prescribed SST fields (Reynolds 1° lat x 1° long SSTOI product, updated weekly), and the regional models applied prescribed lateral boundary conditions around the perimeter of approximately NAME Tier 2. Otherwise each group was free to choose its own model resolution, land surface treatment, and set of physical parameterizations. Considering the range of model types and setups, the NAMAP exercise is not a clean model intercomparison effort. Instead it is intended to illustrate a general range of model simulation quality and thereby identify general challenges pertaining to monsoon modeling.

A NOAA Atlas, available online via a link from the NAME webpage, describes the models and contains a summary of key results. A few of these results were shown at VPM7 illustrating that all the models successfully simulate the overall seasonal evolution of the 1990 North American monsoon season. However the quantitative spread among the simulated precipitation amounts, amplitude and phase of diurnal variability of precipitation, and surface fluxes over the continent, is extremely large. There is little or no validation data at present for some of these quantities. The spread of these modeling results has motivated goals for modeling improvement, aimed at obtaining the necessary validation data and provoking model development efforts to improve the ability of the models to simulate the seasonal and diurnal behaviour of the monsoon system.

NAMAP has provided a valuable benchmark for future NAME-related modeling efforts and has prompted the formulation of ambitious, but realistic, metrics for assessing the value of the overall NAME project. The NAME breakout sessions later during VPM7 include discussion time to develop a follow-on model assessment and development effort based on the 2004 field campaign season.

2.12 CLIVAR modeling

Dr. Ben Kirtman (COLA and George Mason University), co-chair of the International CLIVAR Working Group on Seasonal to Interannual Prediction (WGSIP), described the activities of WGSIP and presented a report on the newly emerging Coordinated Observations and Prediction of the Earth System (COPES) Task Force on Seasonal Prediction (TFSP)

WGSIP has broad terms of reference, essentially covering the 'GOALS' research area of CLIVAR, with particular responsibility for a global viewpoint and an emphasis on prediction. As well as considering seasonal forecasting issues globally, the group was asked to pay particular attention to specific scientific issues (such as the role of land interactions in our systems, and working toward 'seamless' forecast systems). Attempt is made to keep in touch with the user community, to ensure that developments in forecast outputs are appropriate.

To remain well focused on the key aspects of seasonal and interannual predictability, WGSIP will need to work closely with the CLIVAR regional panels. This is important both to maximise scientific return on numerical experimentation, and enable CLIVAR to give the appropriate level of attention to the many aspects of seasonal forecasting and its associated science. This enhanced regional panel interaction is also critical for WGSIP-TFSP activities.

The aim of WGSIP is to develop a programme of numerical experimentation for seasonal-to-interannual variability and predictability, paying special attention to assessing and improving predictions. Further research aims are to develop appropriate data assimilation, model initialization and forecasting procedures for seasonal-to-interannual predictions, and to consider such factors as observing system evaluation, use of ensemble and probabilistic methods and statistical and empirical enhancements, and measures of forecast skill.

Among other activities, the CLIVAR Working Group on Seasonal to Interannual Prediction (WGSIP) successfully conducted the following projects:

Intercomparison of Nino3.4 Prediction
The purpose of this comparison project is to assess the state-of-the-art in predicting tropical Pacific sea surface temperature anomalies (SSTA). In order to make this assessment, retrospective forecasts of NINO3 (150º-90ºW, 5ºS-5ºN) SSTA made by various research groups have been compared. Six dynamical (of various degrees of sophistication) prediction systems and one statistical prediction systems were considered (see Kirtman et al., 2001, http://www.clivar.org/publications/wg_reports/wgsip/nino3/report.htm).

Remarkably, a forecast developed as a consensus of at least three separate prediction systems is arguably more skilful than any of the individual prediction systems. Comparisons have also been made to determine how well the models forecast the various phases of ENSO. Both the dynamical and statistical models produce useful forecast of the peak phase of the extreme warm and cold events up to two seasons in advance. However, none of the models adequately capture the detailed life cycle of the ENSO events nor are the models particularly good at predicting the timing of the onset of El Niño events.

Intercomparison of ENSO simulations in coupled models (ENSIP)
An ensemble of 24 coupled ocean-atmosphere models has been intercompared with respect to their performance in the tropical Pacific (Latif et al., 2001, *Clim. Dyn.,* **18** , 255-276).

Almost all models still have difficulties in simulating the SST climatology, although some improvements are found relative to earlier intercomparison studies. Only a few of the coupled models simulate the El Niño/Southern Oscillation (ENSO) in terms of gross equatorial SST anomalies, although heat content variation is similar to that observed in almost all models. Finally, the majority of the models show a strong connection between ENSO and the strength of the Indian Summer Monsoon.

Study of tropical oceans in climate models (STOIC)
The behaviour the tropical ocean in coupled ocean-atmosphere models was compared on seasonal and interannual time scales, focusing on the Atlantic and Indian regions and the relationships with the Pacific region (Davey, et al., 2002, *Clim. Dyn.*, **18** , 403-420).

The annual mean equatorial SST in the central Pacific is generally too cool, while in the Atlantic the zonal gradient has the wrong sign in almost all models. The interannual SST variability in the equatorial Pacific is commonly too weak, few models correctly simulate the observed Pacific 'horseshoe' pattern of negative correlations with Niño3 SST anomalies, and few models correctly simulate observed Indian-Pacific lag

correlations. None of the models have an equatorial Pacific seasonal cycle for upper ocean vertically averaged temperature like that observed.

SMIP
Two experimental protocols using atmospheric general circulation models have been set up to investigate: 1) potential seasonal predictability (SMIP-2) using observed SST, and 2) actual predictability using forecast SST (SMIP-2/HFP). The basic experiment calls for ensembles of integrations, differing only by their initial conditions, for each season for 1979-2000.

Results regarding the predictability of the Asian summer monsoon have been published based on a pilot SMIP project: Sperber, et al, 2001, *Mon. Wea. Rev.*, **129,** 2226-2248. Additional Asian Monsoon results can be found in Kang et al., 2002, *J. Climate*, 15, 2791-2805 and in Kang et al., 2002, *Clim. Dyn.*, 19, 383-395.

Multi-model Ensemble Methods
Multi-model ensemble methods are increasingly used for climate prediction. Studies have shown that in general the usage of multimodel approaches increases the forecast skill above that attained by any individual model.

Future Plans
It is now recognized that there is currently untapped seasonal predictability due to interactions (and memory) among all the elements of the climate system (Atmosphere-Ocean-Land-Ice). A new major WCRP activity called the Coordinated Observation and Prediction of the Earth System (COPES) aims to exploit this predictability by developing seamless (i.e., from weeks to decades) predictions of the total climate system. CLIVAR will work through WGSIP and the recently formed COPES Task Force for Seasonal Prediction (TFSP) in coordinating the implementation of these total climate system predictions.

2.13 NAME 2004 Enhanced Observations

Dr. David Gochis (NCAR/RAP, Boulder, CO, USA) reported that numerous instrument platforms were deployed to the Tier I region of NAME for several weeks during July and August, a period which climatologically defines the onset and mature phase of the monsoon. These platforms included numerous surface meteorological stations, an enhanced event-based rain gauge network, several surface flux towers, soil moisture monitoring equipment, pilot balloons (PIBALS), a network of enhanced sounding systems, some of which contained real-time transmitting wind profilers, a research aircraft and an oceanic research vessel. In addition to the limited duration deployment of research equipment, national observing networks from the U.S. and Mexico, including radiosondes and weather surveillance radars, also participated in data collection. Combined, these instruments were aimed at characterizing the time-varying patterns of moisture flux into various regions of the North American Monsoon and their subsequent effect on precipitation. Enhanced sounding operations were coordinated with aircraft missions to increase both the sampling frequency and density of the atmosphere during the core period of the monsoon. Intensive Observation Periods (IOPs) were called throughout the field campaign to better sample specific features of the monsoon, such as propagating synoptic disturbances. While many of the instrument platforms were deployed on a temporary basis, several platforms, including the event-based and simple rain gauge networks, and enhancements to the Mexican weather radars, are intended to be left as permanent upgrades to the weather and climate observing system.

3. Review of Climate Research in Ecuador

As it is a tradition in VAMOS meetings, a session was dedicated to highlight research and related activities by members of the hosting institution.

3.1 Seasonal Heat Balance in the Eastern Tropical Pacific

Professor Maria del Pilar Cornejo de Grunauer (ESPOL) is investigating the processes that control sea surface temperature (SST) variability in the eastern tropical Pacific (ETP) in a region from 10°N through 20°S, and from 120° to the South American coast. She has analyzed the atmospheric and oceanic fields that play an important role in the oceanic heat balance of the upper layer (30m), and the long-term mean and

seasonal variability of the wind and thermal fields and near-surface circulation. A comparison between four wind products shows that the Florida State University (FSU) subjectively analyzed pseudo-stress wind is the most suitable product for diagnosing the ocean behaviour in the ETP for the 1979-1993 period.

The analysis shows that the relative importance of the terms in the heat balance equation for the upper layer (30m) of the ETP varies in the meridional direction. From this viewpoint three different zones were identified: 1) the north equatorial countercurrent- intertropical convergence zone (NECC-ITCZ; 4°-10°N), 2) the cold tongue-south equatorial current zone (SEC; 2°N-4°S), and 3) the slow westward drift zone (10°-20°S). Within the NECC-ITCZ, the warming by the surface heat flux is balanced by the divergence of the vertical diffusive heat flux. The annual average of the horizontal plus vertical diffusive flux is similar to that of the entire northeastern Pacific warm pool about – 40Wm^{-2} as estimated by others. In the cold tongue-SEC, the permanent maximum in surface warming by the surface heat flux is balanced primarily by advective cooling (71%) within the upper layer, and secondarily by vertical diffusive cooling (22%); the main contributor to the advective fluxes being the vertical component (upwelling). Lateral diffusion is not an important contributor because it is very small (5-10Wm^{-2}) due to the reduced horizontal temperature gradients within the 30-m slab (4-8 times smaller than the SST gradients). South of 10°S the oceanic terms are small and the balance is primarily between the heat storage rate and the surface heat flux all-year round. The large seasonal cycle of SST off Chile and Peru is therefore a direct response to the very large annual variation of solar heating due to the highly seasonal stratocumulus cloud regime.

The annual average of the residuals in the heat balance equation is slightly negative, between –5 and –10Wm^{-2}, whereas a nil result is expected by design. The residual analysis shows that the offset can be easily accounted for by uncertainties in the bulk formulas used to derive the terms in surface heat fluxes, errors due to poor data coverage, and/or underestimation of the cooling by advection or diffusion.

3.2 Potential ways of cooperation between CIIFEN and VAMOS

Dr. Rodney Martinez (Centro Internacional para la Investigación del Fenómeno de El Niño , CIIFEN), presented details on the mission, vision and history of this institute, which was created with support from the WMO (World Meteorological Organization), the EIRD (International Strategy for the Reduction of Disasters) and the Government of Ecuador.

Focused on the study of El Niño and climate variability, CIIFEN is devoted to scientific research addressed to improve El Niño forecasting; climate applications to generate risk scenarios (agriculture, fisheries, health, water, tourism, environment); early warning in regional and subregional scale trough modeling; develop adaptations scenarios on El Niño and Climate Change; capacity building and regional networks coordination; develop virtual libraries, and rescue of El Niño regional gray literature.

Dr. Martinez gave examples of pilot projects and El Niño-related application activities under development at CIIFEN. The center aims at implementing a regional model for climate alert, as well as an operational climate alert system at regional and sub regional scales. CIIFEN seeks to foster interaction between ongoing research programs in the region, such as the ERFEN Program and in particular CLIVAR/VAMOS, PACS-SONET, IAI, IRI, JCOMM, universities and research centers and the recent GRASP (GOOS Regional Alliance for Southeastern Pacific) among others. It also aims at integrating the knowledge from observational programs under way in the region – e.g., Naylamp in Perú, Spondylus in Ecuador – and observations in Chile, Colombia and Venezuela. The cooperation CIIFEN – VAMOS can be the way to build this institutional synergy.

4. VOCALS Working Group Report

Dr. Robert Weller (WHOI) reported that the VOCALS working group concentrated on the advancement of plans for implementation of work to address VOCALS issues and hypotheses that have been developed around them. Particular attention was given to further development of the science and implementation plans for a process experiment, with the intent to develop a timeline leading up to and including the process study. In attendance were Chris Bretherton, Robert Weller, Oscar Pizarro, Rodrigo Nunez, Jose Rutllant, Rene Garreaud, Efrain Rodriguez, C, Roberto Mechoso, Chris Fairall, Pilar Cornejo, Rodney Martinez, Gus

Emmanuel, Edwin Pinto, Leila Zambrano, and others. At this meeting, chairmanship of the VOCALS Scientific Steering Committee (SSC) passed from Chris Bretherton to R. Weller.

The overall goal of VOCALS is to develop and promote scientific activities leading to an improved understanding and model simulation of the southeastern Pacific stratocumulus decks, their interaction with weather systems (including deep convection), the seasonal cycle and interannual climate variations over South America, their feedback with the underlying ocean, and their response to and impact on variability in remote locations. These activities include diagnostic and modeling studies, sustained observations, and pilot and enhanced observational programs, including a multi-investigator, cooperative process study.

The scientific rationale for VOCALS was developed at past VAMOS meetings, with major progress made at VPM7 in Miami. Among the scientific issues to be addressed are: On what time and space scales does continental heating/mechanical forcing impact boundary layer cloud/radiative forcing? How sensitive is the overall tropical circulation and ENSO to variations of Eastern Pacific cloud topped boundary layer properties and why? What are dominant seasonal/interannual feedbacks among stratocumulus clouds, surface winds, upwelling, coastal currents and SST in E Pacific? Does natural and anthropogenic aerosol variability significantly modulate the Sc? Further offshore, the cloud drop radii are larger; Why? Because there is more aerosol near the coast? Pollution? Ocean productivity, DMS? Salt/wind? How does this feedback on mean Sc albedo? Vertical PBL structure? What processes control SST and upper ocean heat content and structure over the domain? What is the connectivity of the ocean to remote regions? How sensitive is the stratus deck to local ocean variability? What controls SST? What are the roles of Ekman transport, eddy heat transport to the west, local air-sea interaction and other processes? What drives vertical mixing at buoy and do ocean GCMs replicate the heat balance and the mixing processes? What is the horizontal extent of nutrients and its relation to offshore transport mechanisms? What is the space/time nature of eddy heat transport offshore? How does the vertical ocean (and atmosphere) cross-section along a latitude line? Is regional ocean modeling of 1500 km nearest South American coast realistic? Is regional atmospheric modeling along the coast realistic? Does it replicate the coastal wind jet and its relation with coastal upwelling and clouds? How coupled are the oceanic and atmospheric boundary layers? Does local forcing drive the seasonal cycle of SST? Are there continental influences on long timescales? Are there cloud feedbacks on ENSO ?

The VOCALS SSC identified October of 2007 as the time period best for the process study; climatologically, October is the time of the largest extent of the stratus cloud deck. Up to and through that time global and mesoscale model evaluation and improvement would be undertaken using multiscale data sets. Observations now underway include the WHOI surface mooring at 20°S, 85°W, the SHOA DART buoy at 20°S, 75°W, meteorological observations at San Felix Island, cruises to service the WHOI buoy, cooperative cruises by Chile, Perú, Ecuador, and Colombia, coastal subsurface moorings deployed by the U. Concepción, and the annual cruise to service the WHOI and DART buoys (each October or November). The WHOI buoy was deployed in October 2000 and was a focal point for EPIC2001 fieldwork done in October 2001 as a pilot for VOCALS. The DART buoy was deployed in November 2003. Standard surface observations are taken at San Felix by the Chilean Navy; the U. Chile began to add additional instrumentation in late December 2002.

Planning at VPM 8 for the October 2007 process study led to development of the following framework: Use of a research aircraft (NCAR C-130) flying long, basically east-west legs from northern Chile with cloud radar, sampling for aerosols, cloud microphysics, fluxes, with dropsondes and passive microwave; both constant level and profiling flight legs. Use of aerosondes flying from northern Chile or from San Felix Island for boundary layer profiling and radiation and aerosols if possible. A large oceanographic research vessel (NOAA Ship Ronald H. Brown) to work west from the coast out past the WHOI buoy in a large scale radiator pattern extending down to San Felix to do oceanography (towed SeaSoar and underway ADCP, physical and biological sampling), deploy Argo profiling floats and surface drifters, air-sea exchanges, and carry cloud radar, C-band radar, lidar, radiosondes, aerosol sampling. Use of a coastal oceanographic ship addressing the meteorology, physical and biological oceanography and coupling of the ocean, atmosphere and land in the near-shore region. Use of the late 2007 CPPS cruise to do additional sampling of coastal oceanography and meteorology. On station at that time would be the WHOI buoy at 20°S, 85°W, the SHOA DART mooring at 20°S, 75°W, and the U. Concepción coastal moorings. Use of sampling done on the annual transect to Easter Island made by SHOA. Augmentation of the instrumentation on San Felix and

coastal meteorological sampling sites. Use of satellite remote sensing for large-scale coverage of the ocean surface, sea level height, atmospheric state, and clouds.

In preparation for the VOCALS process experiment in October 2007, enhanced sampling is recommended using the SHOA DART buoy (add meteorological sensors), using San Felix (resolve power reliability and add enhanced instrumentation, including wind profiler, radiation, cloud/precipitation radar, microwave liquid water profiler, and aerosol sampler), from the October or November cruises (using the NOAA ETL surface flux and remote sensing instrumentation) to service the WHOI and DART buoys, by adding additional ARGO floats and surface drifters to the region, by sampling from CPPS and Peruvian and Chilean cruises in the region.

Efforts will continue in diagnostic, sensitivity, parameterization studies of southeastern Pacific stratocumulus and their variability using data collected to date, satellite and model products, and the enhancements to the observations noted above. Ocean diagnostic and modeling studies will begin using data now being collected and the historical data to refine sampling strategies aimed at quantifying the relative roles of air-sea interaction, Ekman transport, eddy transport, geostrophic transport and other processes in setting SST under the stratus clouds. Model studies will also examine the influence of remote forcing (for example, at the equator where a Kelvin wave could be excited that propagates east to create a coastal trapped wave that moves south into the region of interest) on the oceanographic and meteorological variability of the region. Global atmospheric and coupled models will complement the regional oceanographic and meteorological modeling.

VOCALS data management efforts will spin up to collect, archive, and share remote sensing data, model data, and the field data. Links will be maintained with the US CLIVAR Cloud – Climate Process Team (CPT) that will be working to transition better understanding and parameterizations into coupled model development. Contacts will be made with international CLIVAR in order to solicit possible interest from several model working groups.

The preparations for October 2007 will lead up to a 'dry-run' of the VOCALS experiment, in which the plans for ship and aircraft tracks will be tested and refined using model and satellite fields together with data from the 2003-2006 WHOI buoy servicing cruises. The timeline for enhancements to San Felix, the DART buoy, and coastal installations are set by the desire to have these enhancements operational for this 'dry-run' and to ensure data collection in 2006 as well as in 2007 to cope with and observe possible interannual variability.

5. MESA Working Group Report

Professor C. Vera provided a summary of the MESA working group sessions. The VPM7 charge to MESA was to address the following: 1) reformulation of the work plan on the “South American core monsoon”, and 2) redefinition of projects on LPB (LPBP CSE, GEF funded project, PLATIN) and identification of active regional players.

It was proposed in VPM6 that MESA should start integrating the objectives of the different programs in South America (SALLJEX, PLATIN, LBA) in an unified program in order to facilitate the understanding, simulation and prediction of the different components of the South American Monsoon System (SAMS), their variations and connections with the extratropics. Integration of the objectives would also help to identify links between MESA and other programs such as NAME, PIRATA and the CLIVAR programs in Africa. Therefore, a new MESA structure was discussed in order to better address the main MESA goal related to the SAMS variability and the improvement of the SAMS monthly-to-seasonal prediction.

The working group suggested that MESA be organized in three main priority research areas (PRAs): 1) diurnal and mesoscale variability (PRA1), 2) intraseasonal variability (PRA2), and 3) interannual (and longer timescale) variability (PRA3). There was also agreement that the MESA domain be extended from the Amazon Basin to the La Plata Basin. Further discussions on the extension of the MESA region of interest were made. Areas like Northeast Brazil and the northern part of tropical South America have not received any attention yet. The discussion on MESA strategy will continue in a meeting of a wider portion of the MESA community to be held during the CLIVAR Conference in June 2004.

The group also agreed on several issues that must be addressed in order to achieve a better understanding of the sources and limits of seasonal predictability over South America. To what extent do model systematic errors affect seasonal predictability in the region? Seasonal climate predictions are more accurate during strong ENSO years: what about normal, weak-ENSO or la Niña events (i.e., most of the time)? Will seasonal predictability change as a function of land cover changes? Can soil moisture memory help for seasonal predictions for South America? Dealing with the complexities of orography: higher resolution models and/or downscaling with regional models? Can intraseasonal oscillations be a source of short-term climatic predictability? At the end, can one expect that model improvements and observational techniques will improve predictability in regions such the highly populated and economically important one in southeastern South America? Better seasonal climate predictions, more accurate projections of climate change scenarios for the future? Also there was agreement that some modeling issues after SALLJEX are still open. Does SALLJEX data improve the understanding of the water budget of LPB? Has the uncertainty of the moisture transport by the SALLJ been reduced? Does SALLJ research improve the numerical model skill for predicting MCSs?

The group had several recommendations for PLATEX and LPB CSE:

- Numerical experiments over the basin may be used for a better experiment design of PLATEX, which it is still in its planning stages. Can PLATEX contribute to understand the predictability levels of the region? Does it need special observation systems?

- An enhanced monitoring could be implemented by 2007 in order to describe the diurnal cycle of precipitation over the middle portion of LPB, using LBA rain gauges and a radar over the region where MCS achieve their mature stage. Flux towers (4 potential one-dimensional reference sites for CEOP) currently operating in southern Brazil would be available too.

Finally, the group considered additional coordinated numerical experiments to be performed by the SALLJEX modeling group. These could address the impact of improved soil moisture initializations on precipitation simulation, impact of improved initial conditions enhanced by SALLJEX data, data assimilation including SALLJEX data, intraseasonal variability during SALLJEX period, and seasonal mean representation of the SALLJEX period. The group agreed that a VAMOS modeling group could help address MESA objectives through the coordination of joint MESA-NAME-VOCALS activities.

6. NAME Working Group Report

Dr. Wayne Higgins provided a summary of the NAME working group sessions. He started by saying that VPM7 was the best VAMOS meeting ever for NAME.

The NAME working group held three sessions during VPM7: NAME 2004 Field Operations; NAME 2004 Enhanced Observing Period (EOP) and NAME Modeling and Data Assimilation Strategy. The Field Operations session discussed NAME Project Office activities, a draft Field Operations Plan, the NAME Data Catalogue and the NAME Forecast Operations Center. The NAME 2004 EOP session focused on IOP measurement coordination and aircraft operations. The NAME Modeling and Data Assimilation session included discussions of the NCEP Regional Reanalysis, NAMAP2; the NAME CPT and other operational warm season prediction issues. These sessions generated a list of ACTION ITEMS, as well as updates on the NAME 2004 IOP Science Protocols, which were immediately distributed to the NAME community.

The VPM7 charge to NAME was to address the following two questions 1) what additional support does NAME 2004 need from VAMOS? and 2) what are NAME's plans for Tier 3 activities?

In response to question (1), the NAME working group members agreed that NAME 2004 is in very good shape. In particular, it is a major field experiment with modeling activity and good links to operational centers (NWS, SMN).

In response to question (2), Dr. Higgins indicated that NAME 2004 has a major focus on the diurnal cycle of convection in complex terrain. The NAME working group argued that improved monitoring and modeling

of the diurnal cycle will go a long way towards improved warm season precipitation forecasts not just for Tier 1, but for Tiers 2 and 3. The NAME 2004 EOP will not directly address the relative influences of oceanic and continental boundary conditions on NAME Tier 3. However, post-NAME 2004 modeling activities (NAME Roadmap) will address this (see the roadmap in the NAME Modeling and Data Assimilation "White Paper" on the NAME webpage at http://www.joss.ucar.edu/name).

A majority of NAME working group members felt that a VAMOS modeling group could help coordinate joint MESA-NAME-VOCALS activities, make sure that the appropriate modelers participate, and facilitate links with operational centers.

7. NAME Modeling and Data Assimilation Report

Dr. Kingtse Mo presented an assessment of the NCEP regional reanalysis (RR). The precipitation and surface temperature are compared favourably with observations. The RR captures the Caribbean and the Great Plains low-level jets well in comparison with profiler and sounding data. However, the RR may overestimate the magnitude of the low level jet from the Gulf of California. During the NAME 2004, the R-CDAS, which has the same data assimilation procedures and same model, will be performed in 48-hr delayed bases because the boundary conditions from the CDAS and input precipitation data from the CMORPH will not be ready real time. The recommended action item is that the CPC will use the operational EDAS, which will be run real time, for the monitoring support of the NAME operations center briefing.

There will be a "Seasonal Forecast Experiment" to predict seasonal precipitation and surface temperature forecasts for summer 2004. Both statistical and dynamical forecasts are welcomed. The goal is to establish a baseline skill of warm season prediction. The action items are to set up the protocol for the experiment and questionnaires, post them at the UCAR/JOSS website, and extend participation from groups and operational centers.

To improve model simulation of monsoon onset, precipitation amount and diurnal variability and to use the NAME04 data, the NAMAP style activity of the 2004 summer season is planned. The details will be worked out later. The action item is to develop the guidance and protocol for the NAMAP 2 model activity and present them in the next NAME SWG meeting in Tucson, Arizona, US.

8. Plenary discussion on VAMOS Future Directions

The plenary discussion lead by Professor C. Vera and Dr. W. Higgins found consensus that the VAMOS implementation is making considerable progress towards its stated objectives. To help NAME and MESA achieve this goal, empirical and modeling studies plus data set development and enhanced monitoring activities are being implemented, and several field campaigns have been or are being performed (e.g. SALLJEX, NAME 2004). These programs deliver improved infrastructure to monitor and predict the American monsoon systems, more comprehensive understanding of summer climate variability and predictability, strengthened multinational scientific collaboration across Pan America, and measurably improved climate models that predict monsoon variability months to seasons in advance.

There was also consensus that despite significant advances in the understanding of the American monsoon systems, many challenges remain. Additional field programs to address the gaps in the understanding in the monsoon regions, on regional and continental scales, and their result in the improved understanding necessary to advance warm season precipitation prediction must be undertaken.

In order to meet the challenges, all VAMOS components are developing roadmaps with joint modeling activities and credible milestones. The emphasis is on modeling activities that include baseline seasonal simulations that correspond to major field campaigns (SALLJEX, NAME 2004, PLATEX) and multi-year simulations focused on key physical processes (e.g. the diurnal cycle of convection). The North American Monsoon Assessment Project (NAMAP) proved to be an excellent way to benchmark and assess current global and regional model simulations of the North American monsoon and can serve as a prototype for future joint MESA-NAME modeling activities. In addition, joint experimental prediction (e.g. sensitivity to

soil moisture and SST) and product development (e.g. hazards assessments and drought monitors) activities are in the planning stages.

The participants in the discussion agreed on several recommendations for the continued VAMOS success:

- To maintain a yearly frequency for VAMOS Panel meetings.

- To develop a modeling strategy in order to guarantee the existence of strong linkages between all components (MESA, NAME and VOCALS). The panel had endorsed the formation of a VAMOS modeling group. The group will coordinate joint activities of VAMOS components (e.g. MESA, NAME and VOCALS), make sure that the appropriate modelers participate, and facilitate links with operational centers.

- To develop an across-VAMOS "Modeling and Data Assimilation Implementation Plan" that provides a roadmap for VAMOS activities in the following areas:

  (i) Diagnostics and Analysis
  Data Impact Studies (SALLJEX, NAME 2004 and VOCALS)
  Reanalysis (global, regional)

  (ii) Model and Forecast System Development
  Seasonal simulations tied to VAMOS Field Activities (e.g. SALLJEX, NAME 2004, VOCALS); multiyear simulations focused on key processes (e.g. diurnal cycle experiments involving NSIPP, GFDL, NCAR and NCEP global models)

  (iii) Experimental Prediction
  Sensitivity to SST and soil moisture;
  Subseasonal prediction (e.g. MJO)

  (iv) Applications and Product Development
  Assessments (drought monitor, hazards)
  Forecasts (seasonal; subseasonal)
  Applications (regional projects focused on hydrology)

It was also recommended that the VAMOS Panel conduct an assessment of its components. This must include the possible definitions of components that target climate phenomena of great interest in the Americas that are not covered so far. For example, the moisture transport in the Intra-Americas Sea region is particularly important for both the North and South American Monsoon regions. The formation of a small group, led by Dr. Chidong Zhang, was recommended to gather information about the appropriateness of developing this new activity within VAMOS, and in particular to assess the need for an Intra-Americas Sea Experiment (IASE). This IASE group will present a report at VPM8.

9. VAMOS panel executive session

The executive session started with a discussion on panel membership rotation, the terms of this rotation and the terms of reference for panel members. The panel agreed the following:

(1) C. Roberto Mechoso would step down as VAMOS Panel Chair in June 2004 after two consecutive terms and a one-year extension.

(2) Carolina Vera (MESA) and Wayne Higgins (NAME) would co-chair the VAMOS Panel starting in June 2004.

(3) Professor Jose Rutllant and Dr. Maria Silva Dias will rotate off the VAMOS Panel in June 2004. Professor Rutllant completed two consecutive terms and Dr. M. Silva Dias has been appointed as Director of CPTEC.

(4) The panel received the following nominations for VAMOS Panel membership: i) Rene Garreaud (U. Chile; SALLJEX; VOCALS), and ii) Carlos Nobre (LBA representative).

(5) In addition to the NAME chair and MESA chair, the VOCALS chair will become a member of the VAMOS Panel. The current VOCALS chair is R. Weller.

(6) The "Terms of Reference" for VAMOS Panel Membership must be formalized prior to VPM8.

(7) The Panel congratulates the PLATIN SSG for the GEWEX recognition of the La Plata Basin as a CSE. The PLATIN Co-Chairs were asked to present at VPM8 a proposal of organization of the LPB CSE and VAMOS/PLATIN Project.

The discussion on new VAMOS Panel members, as well as the need (or not) to increase their number, was postponed until VPM8. The panel will initiate an e-mail discussion on these issues in late 2004, to be completed prior to VPM8.

The next topic for discussion was the organization of a modeling group for VAMOS. After making several suggestions, the panel agreed that this group would coordinate modeling activities of the program components, making sure that the appropriate modelers participate, and facilitating links with operational centers. Furthermore, this group will be organized by topic (e.g. global, regional, land surface, air-sea, hydrology, ocean). The participation of three basic types of "modelers" will be kept in mind in the formation of the group (assessment of model performance, improvement of model performance, design of new model components). Nominations for membership in the modeling group will be requested by e-mail in order to collect the inputs and advice of panel members. The co-chairs will ask the CLIVAR SSG to endorse the plans for the group at their June 2004 meeting.

The last items considered at the executive session were the themes and venue for the next panel meeting. It was decided that the main theme at VPM8 will be modeling and data assimilation. The “IASE” working group will be invited to make a presentation. Invitations will be distributed to experts on modeling. VPM8 will be held late March/early April 2005, and should be coordinated with other meetings (i.e. NAME data analysis meeting). Possible venues for VPM8 include Mexico City, Colombia or Costa Rica.

10. Acknowledgements

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Appendix 2: Agenda

WCRP/CLIVAR Seventh Annual Meeting of theVAMOS Panel,
Guayaquil, Ecuador, 22-24 March 2004

Monday, March 22, Morning Session, Plenary, Chair: M.Pilar Cornejo de Grunauer

8:50am	Opening of VPM7 – M.Pilar Cornejo de Grunauer (Organizing Committee)
9:00am	Welcome – Ing. Armando Altamirano , Vicerector General Escuela Superior Politécnica del Litoral (ESPOL) – Prof. Carlos E. Ereño - CLIVAR-ICPO – Prof. C. Roberto Mechoso - VAMOS Chair
9:20am	VAMOS Chair's Report – C. R. Mechoso
10:00am	VOCALS Status Report – C. Bretherton
10:30am	Break
11:00am	VAMOS Database – J. Meitin, S. Williams
11:30am	US CLIVAR Report – R. Weller
12:00am	CLIVAR ICPO – C. Ereño
12:15am	VAMOS International Project Office: Status and current activities in preparation for the NAME field phase – G. Emmanuel
12:30pm	Break

Monday, March 22, Afternoon Session – First Part, Plenary, Chair: C. Roberto Mechoso

1:30pm	MESA Status Report – C. Vera
2:00pm	NAME Status Report - W. Higgins
2:40pm	SALLJEX Modeling Activities – C. Saulo, C. Vera
3:00pm	NAME Modeling and Diagnostic Activities: CPT and Forecast Experiments – K. Mo
3:20pm	NAME Modeling and Diagnostic Activities: NAMAP – D. Gutzler
3:40pm	CLIVAR Modeling – B. Kirtman
4:00pm	Charge to the Workshop – C. R. Mechoso
4:20pm	Break

Monday, March 22, Afternoon Session – Second Part, WGs meet

4:40pm	WGs meet: VOCAL, MESA, NAME
6:00pm	End of session

Tuesday, March 23, Morning Session – First Part: Plenary, Chair: Wayne Higgins

8:30am	NAME 2004 Enhanced Observations – D. Gochis, M. Douglas

Tuesday, March 23, Morning Session – Second Part, WGs meet

8:50am	Break – out: WGs meet: VOCAL, MESA, NAME
12:30pm	Break

Tuesday, March 23, Afternoon Session – First Part, WGs meet

1:30pm	Break – out: WGs meet: VOCALS, MESA, NAME
4:40pm	Break

Tuesday, March 23, Afternoon Session – Second Part, Plenary

5:00pm	An update on Ecuadorian Research related to VAMOS – M.Pilar Cornejo de Grunauer
5:15	Seasonal Heat Balance in the Eastern Tropical Pacific – M.Pilar Cornejo de Grunauer

5:40 Potential ways of cooperation between CIIFEN and VAMOS – Rodney Martinez
6:00pm End of session

8:00 pm Cocktail offered by ESPOL

Wednesday, March 24, Morning Session – First Part, WGs meet

8:30am Break – out: WGs meet: VOCAL, MESA, NAME
12:30pm Break

Wednesday, March 24, Afternoon Session – First Part, Plenary, Chair: Carolina Vera

1:30 pm VOCAL Strategy Report –
2:00 MESA Strategy report – NAME report –
2:30 General overview and discussion on future directions – C. Vera & W. Higgins
3:00pm Break

Wednesday, March 24, Afternoon Session – Second Part: Panel Session

3:30pm VAMOS Executive Session: Panel membership, next meeting.
6:30pm End of VPM7

Appendix 3: Acronyms

Most of the acronyms used in this report are listed here. More can be found at http://www.clivar.org/publications/other_pubs/iplan/iip/appendix_6_acro.htm

ADCP	Acoustic Doppler Current Profiler
ARGO	Array of temperature/salinity profiling floats
CDAS	Climate Data Assimilation System
CEOP	Coordinated Observing Period of the GEWEX
CIC	Intergovernmental Committee for La Plata Basin
CICESE	Centro de Investigación Científica y Educación Superior de Ensenada, México
CIIFEN	Centro Internacional para la Investigación del Fenómeno de El Niño
CIMA	Centro de Investigaciones del Mar y la Atmósfera
CLIVAR	Climate Variability and Predictability (WCRP component)
CLOUDSAT	Experimental satellite to measure cloud properties
CMORPH	NOAA CPC Morphing Technique
COLA	Center for Ocean-Land-Atmosphere Studies
CONICET	Consejo Nacional de Investigaciones Científicas y Técnicas
COPES	Coordinated Observations and Prediction of the Earth System
CPC	Climate Prediction Center
CPPS	Comisión Permanente del Pacífico Sur
CPT	Climate Process Team
CPTEC	Centro de Previsão de Tempo e Estudos Climáticos
CSE	Continental Scale Experiment
DART	Deep-ocean Assessment and Reporting of Tsunamis
DMS	Dimethyl sulfide
ECMWF	European Centre for the Medium Range Weather Forecast
ENSIP	ENSO simulation in coupled models
ENSO	El Niño – Southern Oscillation
EOP	Enhanced observing period
EPIC	East Pacific Investigation of Climate Processes in the Coupled Ocean-Atmosphere System
ESPOL	Escuela Superior Politécnica del Litoral, Ecuador
ETP	Eastern Tropical Pacific
GAPP	GEWEX America Prediction Project
GCM	General Circulation Model
GCOS	Global Ocean Observing System
GEF	Global Environmental Facility
GEWEX	Global Energy and Water Cycle Experiment (WCRP component)
GFDL	Geophysical Fluid Dynamics Laboratory (USA)
GHP	GEWEX Hydrometeorology panel
GOALS	Global Ocean Atmosphere Land System (CLIVAR component)
GOES	Geostationary Operational Environment Satellite
GOOS	Global Ocean Observing System (IOC)
GRASP	GOOS Regional Alliance for Southeastern Pacific

GSOP	Global Synthesis and Observation Panel
IAI	Inter-American Institute for Global Change Research
IASE	Intra-Americas Sea Experiment
ICPO	International CLIVAR Project Office
IMTA	Instituto Mexicano de Tecnología del Agua
INPE	Instituto Nacional de Pesquisas Espaciais, Brazil
IOP	Intensive observing period
IRI	International Research Institute for Climate Prediction
ITCZ	Intertropical Convergence Zone
JCOMM	Joint WMO/IOC Commission for oceanography and marine meteorology
LBA	Large Scale Biosphere-Atmosphere Experiment in Amazonia
LPB	La Plata Basin
LPBP	LPB Climate and Hydrology Project
MCS	Mesoscale Convective System
MESA	Monsoon Experiment in South America
MJO	Madden–Julian Oscillation
MODIS	Moderate Resolution Imaging Spectroradiometer
NAMAP	North American Monsoon Model Assessment Project
NAME	North American Monsoon Experiment
NAME04	NAME field experiment 2004
NASA	National Aeronautics and Space Administration, USA
NASA THP	NASA Terrestrial Hydrology Program
NCAR	National Center for Atmospheric Research, USA
NCEP	National Centers for Environmental Prediction, USA
NECC	North Equatorial Counter Current
NOAA	National Oceanic and Atmospheric Administration, USA
NOAA ETL	NOAA Environmental Technology Laboratory
NOAA OGP	NOAA Office of Global Programs
NOAA PACS	NOAA Pan-American Climate Studies
NSF	National Science Foundation, USA
NSIPP	NASA Seasonal-to-Interannual Prediction Project
NWS	National Weather Services
OAS	Organization of American States
PACS-SONET	Pan American Climate Studies Sounding Network
PBL	Planetary boundary layer
PIBALS	Pilot Balloon upper air observations
PLATIN	La Plata Basin Project
POES	Polar Operational Environmental Satellite
PRA	Priority research areas
PUMP	Pacific Upwelling and Mixing Physics
RAP	Research Applications Program
SALLJ	South American Low Level Jet
SALLJEX	South American Low Level Jet Experiment
SAMS	South American Monsoon System

SDA	SALLJEX Data Archive
SEC	South Equatorial Current
SHOA	Servicio Hidrográfico y Oceanográfico de la Armada de Chile
SMEX04	Soil Moisture Field Experiment
SMN	Servicios Meteorológicos Nacionales
SOAP	Subtropical Ocean–Atmosphere Processes
S-POL	S-band Dual Polarization Doppler Radar
SSC	Scientific Steering Committee
SSG	Scientific Steering Group
SSG-13	13th meeting of CLIVAR SSG
SST	Sea Surface Temperature
SSTA	Sea Surface Temperature Anomalies
SSTOI	Sea Surface Temperature Optimum Interpolation
STOIC	Study of Tropical Oceans In Coupled models Science Working
SWG	Group
TEPPS	Tropical Eastern Pacific Process Study
TFSP	Task Force on Seasonal Prediction
UCAR	University Corporation for Atmospheric Research, USA
UCAR JOSS	UCAR Joint Office for Science Support
UNAM	Universidad Nacional Autónoma de Mexico
UNEP	United Nations Environment Programme
US CLIVAR	US contribution to CLIVAR
VAMOS	Variability of the American Monsoon Systems
VOCALS	VAMOS–Oceans–Clouds–Atmosphere–Land Studies
VPM7	7th meeting of CLIVAR VAMOS panel
WCRP	World Climate Research Programme
WGOA	Working Group on Observation and Assimilation of the Climate System
WGSIP	CLIVAR Working Group on Seasonal to Interannual Prediction
WHOI	Woods Hole Oceanographic Institution, USA
WMO	World Meteorological Organization

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